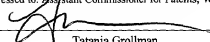


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Tatania Grollman

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the application of:

Terje A. SKOTHEIM et al.

Reissue of Patent No.: 5,961,672

Serial No.: To Be Assigned

Filing Date: Herewith

For: STABILIZED ANODE FOR LITHIUM-  
POLYMER BATTERIES

Examiner: To Be Assigned

Group Art Unit: To Be Assigned

PRELIMINARY AMENDMENT

Box Reissue  
Assistant Commissioner for Patents  
Washington, D.C. 20231

Dear Sir:

Prior to reissue examination on the merits, Applicants respectfully request entry of this Preliminary Amendment for the above-captioned reissue patent application.

## AMENDMENTS

### In the Claims

Please add new claims 56-83 as follows:

--56. An electrochemical cell, comprising a lithium electrode and a sulfur electrode including at least one of elemental sulfur, lithium sulfide, and a lithium polysulfide, said lithium electrode having a lithium metal electrode surface including a surface coating that is effective to increase the cycling efficiency of said electrochemical cell.

57. The electrochemical cell of claim 56, wherein said lithium electrode is in an electrolyte solution.

58. The electrochemical cell of claim 57, wherein said electrolyte solution contains at least one of elemental sulfur, a sulfide, and a polysulfide.

59. The electrochemical cell of claim 58, wherein said surface coating of said lithium electrode is formed prior to contacting said lithium electrode with said electrolyte.

60. An electrochemical cell, comprising a lithium electrode and an organo-sulfur electrode including an organo-sulfur material as a cathode active material, said lithium electrode having a lithium metal electrode surface including a surface coating that is effective to increase the cycling efficiency of said electrochemical cell.

61. The electrochemical cell of claim 60, wherein said organo-sulfur material includes at least one of an organic disulfide and a poly(carbon disulfide).

62. The electrochemical cell of claim 60, wherein said organo-sulfur material is a polymer including at least one of a polymer having the formula  $(CS_x)_n$  where x is from 1.2 to 2.3 and n is greater or equal to 2 and a one-dimensional electron conducting polymer complexed with at least one polysulfurated chain, said polysulfurated chain having no covalent bonds with said conducting polymer.

63. The electrochemical cell of claim 60, wherein said lithium electrode is in an electrolyte solution.

64. The electrochemical cell of claim 63, wherein said electrolyte solution contains at least one of elemental sulfur, a sulfide, and a polysulfide.

65. The electrochemical cell of claim 64, wherein said surface coating of said lithium electrode is formed prior to contacting said lithium electrode with said electrolyte.

66. A battery cell comprising:

a. a positive electrode comprising a mixture of

i. an electrochemically active material, and

ii. an electronically conductive material,

b. a negative electrode comprising a lithium metal electrode surface including a surface coating that is effective to increase the cycling efficiency of said electrochemical cell; and

c. an electrolyte electronically separating the positive and negative electrodes;

wherein said electrochemically active material includes at least one component selected from the group consisting of elemental sulfur, sulfides of lithium, polysulfides of lithium, and combinations thereof.

67. A battery cell comprising:

a. a positive electrode comprising a mixture of

i. an electrochemically active material, and

ii. an electronically conductive material,

b. a negative electrode comprising a lithium metal electrode surface including a surface coating that is effective to increase the cycling efficiency of said electrochemical cell; and

c. an electrolyte electronically separating the positive and negative electrodes;

wherein said electrochemically active material includes an organo-sulfur compound comprising at least one component selected from the group consisting of elemental sulfur, sulfides of lithium, polysulfides of lithium, and combinations thereof.

68. The battery cell of claim 67, wherein said organo-sulfur material includes at least one of an organic disulfide and a poly(carbon disulfide).

69. The battery cell of claim 67, wherein said organo-sulfur material is a polymer including at least one of a polymer having the formula  $(CS_x)_n$ , where x is from 1.2 to 2.3 and n is greater or equal to 2 and a one-dimensional electron conducting polymer complexed with at least one polysulfurated chain, said polysulfurated chain having no covalent bonds with said conducting polymer.

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70. A battery cell comprising:

a) a positive electrode comprising a mixture of

i) an electrochemically active material, and

ii) an electronically conductive material,

the mixture having between about 10% and about 100% of the electrochemically active material accessible to electrons and ionic charge carriers;

b) a current collector electrically connected to the positive electrode;

c) a negative electrode including

i) a metal or a metal ion, and

ii) a protective layer on an electrolyte facing surface of the negative electrode; and

d) an electrolyte separator;

wherein electrochemically active material is selected from the group consisting of elemental sulfur, sulfides of the metal, polysulfides of the metal, and combinations thereof.

71. The battery cell of claim 70, wherein the alkali metal comprises at least one of lithium, sodium, alloys of lithium, and alloys of sodium.

72. The battery cell of claim 70, wherein the protective layer has a thickness of between 100 angstroms and 100000 angstroms.

73. The battery cell of claim 70, wherein the protective layer has a thickness of between 1000 angstroms and 50000 angstroms.

74. The battery cell of claim 70, wherein the electrolyte separator is a liquid electrolyte separator.

75. The battery cell of claim 70, wherein at least about 20% of the electrochemically active material is accessible to electrons and ionic charge carriers.

76. The battery cell of claim 70, wherein at least about 40% of the electrochemically active material is accessible to electrons and ionic charge carriers.

77. A battery cell comprising:

a) a cathode comprising a mixture of

i) a cathode active material, and

ii) an electronically conductive material,

said mixture having a specific capacity of said cathode active material of between 300 mAh/g and 1400 mAh/g;

b) a current collector electrically connected to said cathode;

c) an anode comprising

i) lithium, and

ii) a protective layer on an electrolyte facing surface of said anode; and

d) an electrolyte comprising a separator;

wherein said cathode is selected from the group consisting of elemental sulfur, sulfides of the metal, polysulfides of the metal, and combinations thereof.

78. The battery cell of claim 77, wherein said anode is selected from the group consisting of lithium metal, lithium-tin alloys, lithium-aluminum alloys, lithium-silicon alloys, lithium intercalated carbons, and lithium intercalated graphites.

79. The battery cell of claim 77, wherein the protective layer has a thickness of between 100 angstroms and 100000 angstroms.

80. The battery cell of claim 77, wherein the protective layer has a thickness of between 1000 angstroms and 50000 angstroms.

81. The battery cell of claim 77, wherein said electrolyte is a liquid electrolyte.

82. The battery cell of claim 77, wherein said specific capacity of said cathode active material is at least 600 mAh/g.

83. The battery cell of claim 77, wherein said specific capacity of said cathode active material is at least 700 mAh/g.--

## REMARKS

New claims 56-83 have been added. Entry of the amendment herein prior to reissue examination is respectfully requested, to permit a broadening reissue of the above-reference patent. Basis for the amendment can be found throughout the Specification. Examples of support are detailed below. No new matter is believed to be added by way of this amendment.

Support for claim 56 is found in U.S. Patent No. 5,961,672 (U.S. '672) at col. 2, lines 38-55; col. 3, lines 48-54; col. 4, lines 51-53; col. 5, lines 30-36; col. 9, lines 31-43; col. 11, line 8, to col. 13, line 9; and claims 16-18, 29-31, and 43-45.

Support for claim 57 is found in U.S. '672 at col. 2, lines 53-54; col. 10, lines 33-55; col. 7, line 64, to col. 8, line 2; col. 9, lines 11-20; col. 11, lines 22-27; col. 11, line 67, to col. 12, line 3; col. 12, lines 21-25 and 56-58; and claims 11, 24, and 38.

Support for claim 58 is found in U.S. '672 at col. 11, line 59, to col. 12, line 12; col. 12, lines 21-47; col. 12, line 50, to col. 13, line 9; and col. 9, lines 31-43.

Support for claim 59 is found in U.S. '672 at col. 2, lines 38-55; col. 5, lines 30-36; col. 6, lines 46-50; col. 10, lines 33-55; col. 10, line 61, to col. 11, line 5; col. 11, lines 8-45; col. 11, line 58, to col. 12, line 12; and col. 12, line 50, to col. 13, line 9.

Support for claim 60 is found in U.S. '672 at col. 2, lines 38-55; col. 3, lines 45-48; col. 4, lines 51-53; col. 5, lines 30-36; and col. 9, lines 21-30.

Support for claim 61 is found in U.S. '672 at col. 9, lines 26-29. Support for claim 62 is found in U.S. '672 at col. 9, lines 26-43. Support for claim 63 is found in U.S. '672 at col. 2, lines 53-54; and col. 10, lines 33-55.

Support for claim 64 is found in U.S. '672 at col. 9, lines 31-43. Support for claim 65 is found in U.S. '672 at col. 2, lines 38-55; col. 5, lines 30-36; col. 6, lines 46-50; col. 10, lines 33-55; col. 10, line 61, to col. 11, line 5; and col. 11, lines 8-45.



Support for claim 66 is found in U.S. '672 at col. 2, lines 38-55; col. 3, lines 48-54; col. 4, lines 51-53; col. 5, lines 30-36; col. 9, lines 31-52; col. 9, line 66, to col. 10, line 5; col. 10, lines 11-21; col. 11, line 8, to col. 13, line 9; and claims 16-18, 29-31, and 43-45.

Support for claim 67 is found in U.S. '672 at col. 2, lines 38-55; col. 3, lines 45-48; col. 4, lines 51-53; col. 5, lines 30-36; and col. 9, lines 21-30 and lines 49-52. Support for claim 68 is found in U.S. '672 at col. 9, lines 26-29. Support for claim 69 is found in U.S. '672 at col. 9, lines 26-43.

Support for claims 70 and 77 is found in U.S. '672 at col. 2, lines 38-55; col. 3, lines 45-59; col. 4, lines 51-53; col. 5, lines 30-36; col. 9, lines 21-53. Support for claims 71 and 78 is found in U.S. '672 at col. 2, line 48; col. 5, lines 30-35; col. 6, lines 32-35; col. 10, lines 33-55; col. 10, line 61, to col. 11, line 5; col. 11, line 8, to col. 13, line 9.

Support for claims 72 and 79 is found in U.S. '672 at col. 3, lines 8-9; col. 6, lines 32-37; col. 10, line 33, to col. 11, line 45. Support for claims 73 and 80 is found in U.S. '672 at col. 3, lines 12-14; col. 6, lines 32-37; col. 10, line 33, to col. 11, line 5. Support for claims 74 and 81 is found in U.S. '672 at col. 2, lines 53-54; and col. 10, lines 33-55. Support for claims 75-76 and 82-83 is found in U.S. '672 at col. 9, lines 21-53.

The claims are directed to four groups. The first group includes claims 1-55, which correspond to the claims as previously issued, which are not amended in the amendment herein. Allowance of these claims is respectfully requested. The second group of claims includes claims 56-69; the third group includes claims 70-76; the fourth group includes claims 77-83.

The Examiner's attention is brought to U.S. Patent No. 6,017,651. A copy of this patent is submitted for the Examiner's attention for consideration of possible 102 (g) issues. At least new claims 56-59 of the instant application correspond to claims 1-4 respectively of U.S. Patent No. 6,017,651.

The Examiner's attention is further brought to U.S. Patent No. 6,025,094. A copy of this patent is submitted for the Examiner's attention for consideration of possible 102 (g) issues. At

least new claims 70, 71, 74, 75 and 76 of the present application correspond to claims 31, 32, 35, 36 and 37 respectively of U.S. Patent No. 6,025,094.

Applicants further bring to the Examiner's attention that a reissue application is cofiled today in U.S. Patent No. 5,962,171 (Atty. Docket No. 34474-2001230), which reissue application also includes claims corresponding to U.S. Patent No. 6,017,651 and U.S. Patent No. 6,025,094.

### CONCLUSION

Examination of the claims as amended is respectfully requested.

In the unlikely event that the transmittal letter is separated from this document and the Patent Office determines that an extension and/or other relief is required, applicants petition for any required relief including extensions of time and authorizes the Assistant Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to Deposit Account No. 03-1952 referencing docket no. 344742000530. However, the Assistant Commissioner is not authorized to charge the cost of the issue fee to the Deposit Account.

Respectfully submitted,

Dated: January 24, 2001

By:



Madeline I. Johnston  
Registration No. 36,174

Morrison & Foerster LLP  
755 Page Mill Road  
Palo Alto, California 94304-1018  
Telephone: (650) 813-5840  
Facsimile: (650) 494-0792